

What is claimed is:

1. An impregnated cathode having a cathode pellet in which a pore portion of a sintered body of porous metal is impregnated with electron emitting material, wherein the porosity of said sintered body of porous metal is continuously increased as the distance in a depth direction from an electron emitting face is increased.

2. The impregnated cathode according to claim 1, wherein the porosity of an electron emitting face of said sintered body of porous metal is in the range of 12.5 to 25 volume %; the porosity difference between the porosity of a vicinity of said electron emitting face and the porosity of a vicinity of the face opposite to said electron emitting face is in the range of 5 to 25 volume %; and the porosity of the side opposite to said electron emitting face is less than 40 volume %.

3. The impregnated cathode according to claim 1, wherein the surface roughness of the electron emitting face of said cathode pellet is in the range of 5 to 20 μ m for the maximum height.

4. A method for manufacturing an impregnated cathode having a cathode pellet in which the pore portion of a sintered body of porous metal is impregnated with electron emitting material, comprising the steps of press molding metal raw material powder to form a porous substrate, said press molding being conducted after filling said metal raw material powder in a struck-level cartridge and then filling said raw material metal powder in a die by level striking measurement; wherein a face where said cartridge contacts a die surface has an annular shape and said cartridge has an inclined face in which an end portion of the outside of said cartridge contacts with said die surface.

5. The method for manufacturing an impregnated cathode according to claim 4, wherein an inner diameter of said annular shape is in the range of 10 to 20 times as large as the diameter of the pellet; an external diameter of said annular shape is in the range of 1.05 to 1.3 times as large as said inner diameter; and the angle that said inclined face makes with said die face is in the range of 40 to 80° .

6. The method for manufacturing an impregnated cathode according to claim 4, wherein an amount of metal raw material powder that is filled in said cartridge is equal to an amount of 200 to 800 cathode pellets.

7. The method for manufacturing an impregnated cathode according to claim 4, wherein said metal raw material powder is heated at a temperature in the range of 50 to 100 °C at the time of level striking measurement and pressing.

8. The method for manufacturing an impregnated cathode according to claim 4, wherein a face in which a punch contacts with metal raw material powder is referred to an electron emitting face; the relative descending speed of the punch to a die is in the range of 0.5 to 5 cm/s, and the pressing time is in the range of 1 to 7 seconds when the punch contacts with metal raw material powder.

9. A method for manufacturing an impregnated cathode having a cathode pellet in which a pore portion of a sintered body of porous metal is impregnated with electron emitting material, comprising the steps of: press molding metal raw material powder to form a porous substrate; and sintering said porous substrate to form a sintered body of porous metal; wherein the average porosity of said porous substrate after press molding is

controlled by adjusting the pressure of press molding, and the average porosity of said sintered body of porous metal after sintering is controlled by adjusting the sintering temperature.

5 10. The method for manufacturing an impregnated cathode according to claim 9, wherein porosity distribution is controlled by adjusting the descending speed of the punch and the pressing time.

10 11. The method for manufacturing an impregnated cathode according to claim 9, wherein the average porosity (D volume %) of said porous substrate after press molding and the average porosity (d volume %) of said sintered body of porous metal after sintering have a relationship expressed by the following equation:

$$d + 10 \leq D \leq d + 20.$$

15 12. A method for manufacturing an impregnated cathode having a cathode pellet in which a pore portion of a sintered body of porous metal is impregnated with electron emitting material, comprising the steps of: placing said sintered body of porous metal and said electron emitting
20 material in a container for impregnation in such a manner that said electron emitting material contacts with an entire surface of said sintered body of porous metal when said electron emitting materials are melted; and impregnating the pore portion of said sintered body of porous metal with said electron emitting material.

25 13. The method for manufacturing an impregnated cathode according to claim 12, wherein electron emitting materials are filled in a container for impregnation in such a manner that the depth of the electron emitting materials is uniform, and said sintered body of porous metal is
30 located on the central portion in the direction of the depth of said electron

emitting material or located on the top of said electron emitting material.

14. The method for manufacturing an impregnated cathode according to claim 12, wherein the weight of said electron emitting material to be filled in the container for impregnation is in the range of 10 to 100 times as much as the impregnatable weight of the sintered body of porous metal in the container for impregnation.

15. The method for manufacturing an impregnated cathode according to claim 12, wherein extra electron emitting materials are removed by shaking a container in which an impregnated cathode pellet and alumina balls are placed and washing by ultrasonic cleaning in water.